From Pueblo to Metropolis

Water and Power in the story of Los Angeles

The 1769 discovery of the site of Los Angeles was considered a minor consequence of Spanish enterprise, but viewed from the vantage point of today the discovery was a propitious one because of the many events of exciting significance that thereafter occurred at the site.

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A land expedition to rediscover the Bay of Monterey, commanded by Don Gaspar de Portola, Spanish Governor of California, left San Diego for the north on July 14, 1769. The group of 64 men included Father Juan Crespi who maintained a record of the expedition's progress.

On August 2, 1769 Portola reached a stream which he named Nuestra Senora de Los Angeles de Porciuncula, now called the Los Angeles River. A camp was made on the stream's east bank at a spot near the present North Broadway Bridge.

Father Crespi reported that the "plain where the river runs is very extensive. It has good land for planting all kinds of grains and seeds, and is the most suitable site of all we have seen for a mission, for it has all the requisites for a large settlement." The padre thus was the first to visualize the possibility of a well populated area here. A principal consideration was the river water supply.

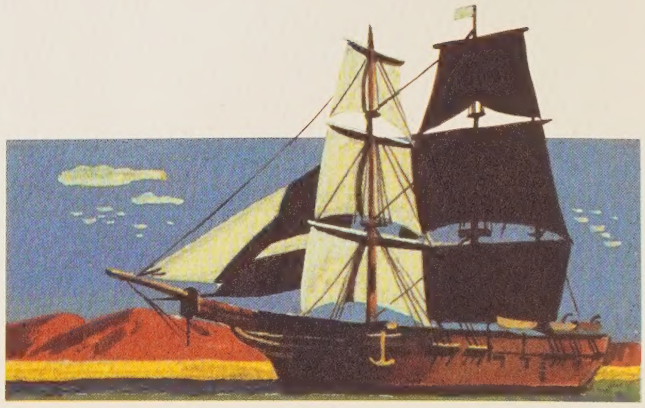
On September 4, 1781 with a nucleus of 11 families recruited from Sinaloa and Sonora in Mexico, the Spanish Officer, Felipe de Neve founded the pueblo La Reina de Los Angeles sobre el rio de la Porciuncula at the site Portola had investigated 12 years previously.

For 69 years the placid existence of the pueblo continued under Spanish and Mexican rule. Changes in the pueblo were few; the rate of growth negligible.

The first census taken in 1850 when Los Angeles was incorporated under American law showed that the town had 1,610 residents. An original survey of Los Angeles made prior to the incorporation by Lieutenant E.O.C. Ord, U.S. Army engineer, provided an accurate description from which our full-color cover illustration was drawn.

Around a central plaza were grouped the principal buildings. Most of the residences were of thick adobe with tiled or asphaltum covered roofs, dirt floors and small window areas.

Open ditches, called zanjas, were the pueblo's water distribution system. The water source was the Los Angeles River.

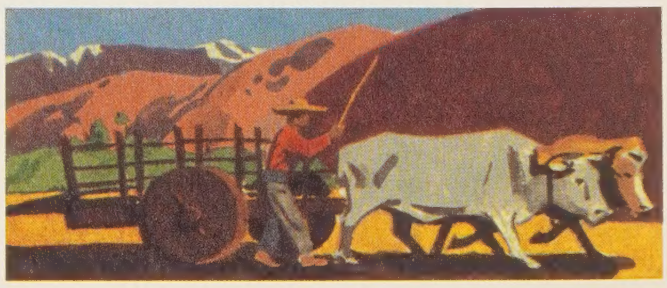


Prospects for the growth and greater development of Los Angeles were not widely anticipated in 1850. The gold seekers from the populous Eastern states and from other parts of the world were bypassing Los Angeles in their haste to reach the northern diggings.

But Los Angeles was on the threshold of enormous changes. The prosperity and excitement engendered by gold discoveries soon spread to the south. Waves of new settlers emigrated to the commercially lucrative, climatically attractive and highly interesting area. Los Angeles' chief commercial activity of the time – cattle raising – entered a boom phase as profitable northern markets for cattle and cattle products were developed.

Great numbers of adventuresome Americans were attracted to this area by the availability and convenience of new railroad services – the Southern Pacific in 1876; the Atchison, Topeka and Santa Fe nine years later.

The stage was set for a phenomenal growth pattern to begin.



From Pueblo to Metropolis

Water and Power in the story of Los Angeles

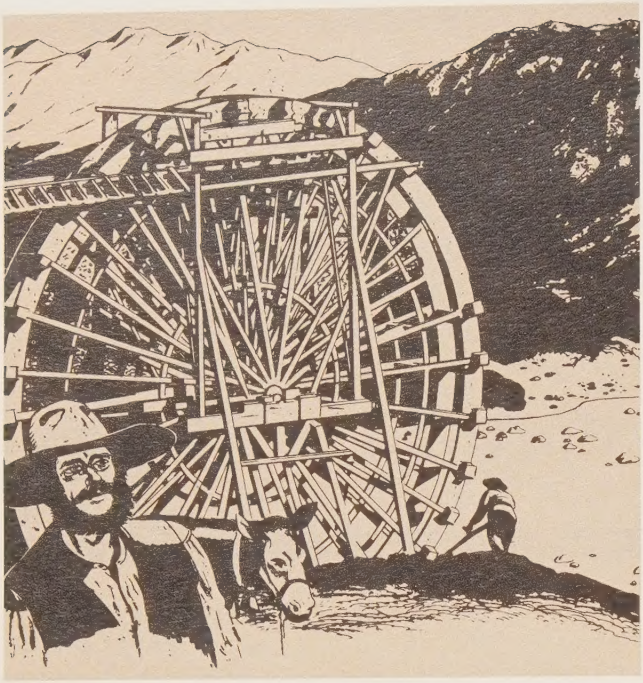
The story of Los Angeles' efforts to secure adequate water supplies and power is an inseparable part of the history of the City.

While the Department of Water and Power began with the establishment of the first Los Angeles municipal water works system in 1902, its roots are firmly planted in the soil of earliest Los Angeles history. In 1781, when the pueblo of Los Angeles was founded, the Los Angeles River water supply was put to use through establishment of the distribution system of crude dams, water wheels and zanjas. The zanja system continued in operation until 1903.

In 1857 the need for more modern methods of domestic water distribution sparked construction of the first water main system of hollowed logs. A giant water wheel on the Zanja Madre, largest of the open ditches serving Los Angeles, and a wood and brick storage tank in the Plaza, were major components of the new distribution system.

The domestic water distribution system was leased in 1868 for 30 years to a private company which began construction of a system of supply lines, cast iron and steel water mains, and storage reservoirs. However, by the end of the contract period in 1898 there was widespread disenchantment with the private operators who were charged with meeting neither the letter nor the spirit of their contract. The City reacquired the water system for $2 million on February 2, 1902, after almost four years of negotiation. Three days later the City's first Board of Water Commissioners was established to manage that system.

The original municipal water bureau and subsequently a municipal power system grew to become today's Los Angeles Department of Water and Power—the nation's largest municipal utility operation.



Early day water wheel raised a portion of the Los Angeles River water supply to a height that permitted gravity flow to homes, fields and storage. For almost 200 years the river water has continuously served the City. Even now, the subsurface water of the river, supplemented by wells in other parts of the City, produces about 70 million gallons of water a day.

The formative years 1900-1910

From a population of 5,728 in 1870, the City had jumped to 11,183 in 1880, and 50,395 in 1890. In 1900 the Los Angeles population was 102,479.

The problems posed by the growth of Los Angeles were being compounded by a serious water shortage. To halt Los Angeles River water use by outside groups and individuals and to conserve the threatened supply, the City instituted a number of successful legal actions to confirm in a court of law its prior and paramount right to the waters of the river.

The new municipal Water Department under the leadership of William Mulholland, its first superintendent and chief engineer, began enlarging the Los Angeles River system of supply and water distribution. Greater storage capacity was provided to conserve a large portion of the river's flow. Construction of new reservoirs, supply lines and mains provided added capacity and efficiency for the system. Negligent use of water by customers was reduced after the installation of meters.

New reservoirs built during this decade included Elysian, Solano, Ivanhoe, Silver Lake and Rowena. A new supply line was built to bring water to the Ivanhoe and Silver Lake Reservoirs from the river near Griffith Park

Mulholland's quest for a plentiful water supply was translated into a bold plan to bring water to Los Angeles from the vast watershed of the Sierra Nevada's eastern slopes. In 1905 the citizens voted a bond issue of $1.5 million to purchase Owens Valley lands and water rights. Two years later another bond issue of $23 million was approved by the voters for construction of a 233-mile long aqueduct. Mulholland, now regarded as ''the Father of the Los Angeles Municipal Water System,'' guided an army of 5,000 men for six years in building the Los Angeles-Owens River Aqueduct, longest municipal aqueduct* in the world. Mulholland's task was completed when Eastern Sierra water was delivered to the City on November 5, 1913.

While the project was under construction, enlargement of the local Los Angeles River supply enabled the City to continue its amazing growth.

**On May 17, 1971 the Los Angeles Owens River Aqueduct was designated as a national historic civil engineering landmark by the American Society of Civil Engineers.*

The development of municipal power was set in motion by the huge aqueduct building program. In 1906 E.F. Scattergood was commissioned as consulting electrical engineer to devise means of developing electric power along the route of the aqueduct. As William Mulholland was the leader in Los Angeles water development, Scattergood was to become the driving spirit in the development of the municipal electric system. The City's first power plant to supply electricity for the construction of the aqueduct was built in 1908 at Division Creek in the Owens Valley.

In 1909 the Bureau of Los Angeles Aqueduct Power was established. Scattergood was appointed its chief electrical engineer. Preliminary engineering work began for the siting of new hydro generating stations along the aqueduct.

Plans were thus made for ample supplies of water and power to fill the impending requirements of the City that in a decade had tripled in population from 102,479 to 319,198.

Mule teams were use to haul pipe sections during construction of the Los Angeles-Owens River Aqueduct.

Major achievements 1910-1920

The possibilities for the further development of hydroelectric power along the aqueduct challenged the imagination of the citizens of Los Angeles. In 1910 they voted to initiate a construction program.

In 1911 a Los Angeles City Charter amendment was adopted which provided general powers for the development and operation of a municipal electric generating and distributing system. The Department of Public Service was created in that year to supersede the Water Department. The new Department consisted of a Bureau of Water Works and Supply and a Bureau of Power and Light.

In an advisory referendum in 1911 Los Angeles citizens overwhelmingly endorsed the principle of municipal distribution of power.

The people of Los Angeles thus made historic decisions early in this century that were to have far-reaching effects on the growth of the City.

The Los Angeles-Owens River Aqueduct project was completed in 1913. The snowfields of the Eastern Sierra began yielding their water to the thirsty southern metropolis. The arrival of this new high quality water supply filled the need occasioned by the expansion of Los Angeles.

The regulating, transmitting and impounding of the new water supply was accomplished by the construction of several reservoirs and major pipelines, Three reservoirs—Lower Franklin Canyon, Chatsworth and Lower San Fernando

Top: Construction of Los Angeles-Owens River Aqueduct through rugged terrain.

Bottom: Early vehicle in the mid-1920's servicing the metropolitan area.

Left: The first power pole in the municipal system was set March 30, 1916 at Piedmont and Pasadena Avenues.

(now known as Los Angeles Reservoir)—were placed in service in the 1915-19 period.

To provide regulation of aqueduct flows, reservoirs were built along the aqueduct route at Haiwee, Fairmont and Dry Canyon. Total storage capacity of these three reservoirs was 68,000 acre-feet* (about 22.2 billion gallons).

By 1914 construction was under way on a hydroelectric power plant on the aqueduct in San Francisquito Canyon and an electric distribution system in the City.

The Bureau of Los Angeles Aqueduct Power was transferred to the jurisdiction of the Department of Public Service in December 1914.

**An acre foot is an amount of water sufficient to cover one acre of land one foot deep—a total of 43,560 cubic feet or 325,850 gallons.*

The first power pole in the municipal system was installed in 1916.

In 1917 San Francisquito Power Plant No. 1 was completed. The City began distributing its own low cost, municipally generated electricity after years of distributing purchased power.

In 1919 citizens voted funds to purchase Southern California Edison Company's entire distribution system within the City of Los Angeles, and to construct additional hydroelectric power plants along the aqueduct.

The development of water and electric facilities during the decade enabled Los Angeles to continue its growth. By 1920 the City's population had risen to 576,573.

Foundations for the future 1920-1930

Several years of below normal snowfall in the Eastern Sierra during the 1920's when Los Angeles experienced unprecedented growth provided evidence that this water supply would be insufficient to take care of Los Angeles' rapidly expanding requirements. Within ten years after the arrival of Owens River water, Department engineers were seeking new sources of supply.

The reduced Sierra water supply and the increasing use of water on privately-owned Owens Valley lands reduced the amount available for Los Angeles. Many deep wells were sunk in the Owens Valley to compensate for the decreasing flow but it became necessary to purchase almost all Owens Valley area private land holdings and their water rights to meet the long term requirements of the City. Nearly 300,000 acres in Inyo and Mono Counties were thus acquired by the end of the decade.

Five important DWP reservoirs were placed in service from 1921 to 1929: Tinemaha on the Owens River, Upper San Fernando (Van Norman), Stone Canyon, Encino and Hollywood. The Hollywood Reservoir dam was the first concrete gravity arch type dam built in Los Angeles. The water system of Los Angeles was expanded through construction of a number of new pumping plants, hundreds of miles of new water mains and thousands of new service connections.

Meanwhile the extended search for water led William Mulholland to the Colorado River. Mulholland began a series of investigations of routes for a new aqueduct to carry water from the Colorado to Los Angeles. In 1925 the Department filed an application with the State Division of Water Resources to appropriate one billion gallons of Colorado River flow daily. Los Angeles citizens approved a bond issue of $2 million for preliminary work on the Colorado River Aqueduct.

By 1921 the City was operating two power plants in San Francisquito Canyon and one in Franklin Canyon. The operating capacity of the Department's generating facilities totaled 61,000 kilowatts.* In 1922 the Department purchase of the Edison distributing system in Los Angeles was completed and municipal electric service began for more than 100,000 new customers.

Recognizing the Colorado River's hydroelectric power possibilities, Los Angeles voters in 1924 authorized contract negotiations for a development program. The people of Los Angeles played major roles in the long struggle to obtain congressional approval for the costly Boulder Canyon Project and authorization for the construction of a high, multiple purpose dam. The congressional act authorizing the project was adopted in

**A watt is a unit of measurement of electrical power. A kilowatt is 1,000 watts. A kilowatt-hour (kwh) equals 1,000 watts of power at work for one hour.*

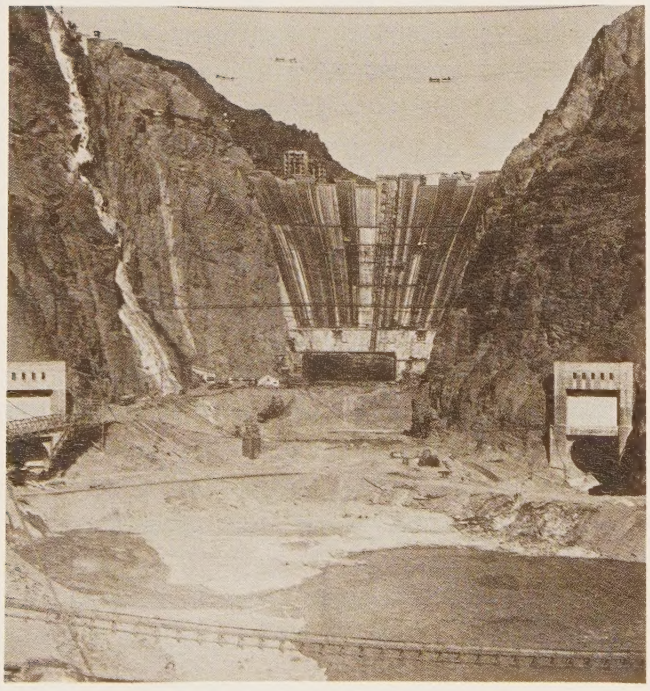
1928. Work was started by the U.S. government in 1931. The final bucket of concrete was poured at Boulder Dam on May 29, 1935.

During the decade additional Los Angeles aqueduct hydroelectric generating capacity was installed. Big Pine, Haiwee and San Fernando Power Plants were built. The electric generating capacity for Los Angeles increased by 44,400 kilowatts.

Electric customers benefited by a series of rate reductions which cut the average domestic rate from 5.6 cents to 4.5 cents per kilowatt-hour.

In 1925 with the adoption of a new Los Angeles City Charter the present Department of Water and Power was established. It assumed the functions of the former Department of Public Service.

By 1930 the Los Angeles population had soared to 1,238,048.



In the 1930's, building of Hoover Dam and Boulder Transmission Line meant added power for Los Angeles.

New giants at work 1930·1940

The period from 1930 to the start of World War II is recorded as a time of economic depression, but population growth continued unabated in Los Angeles.

Two projects—one carrying immense quantities of water, the other transmitting tremendous power—went to work for the people of Southern California when the Colorado River Aqueduct and the Boulder Dam Power Plant (now called the Hoover Dam Power Plant) were completed during the decade.

Even under the depressed economic conditions of the period, Los Angeles citizens willingly voted bond issues to finance expansion of water supply and distribution facilities, the largest of which was a water bond issue of $38 million approved in 1930 by a vote of more than 8 to 1. Much of this money was earmarked for the Mono Basin Project, a construction program to obtain a larger and more dependable flow of water from the Los Angeles Aqueduct.

The project, started in 1934 and completed in 1940 at a cost of $22.8 million, extended the aqueduct 105 miles farther north, 338 miles from Los Angeles. The new intake is 186 miles east of San Francisco's Golden Gate at about the same latitude. During construction a major accomplishment was the drilling of an 11-mile tunnel under the volcanic Mono Craters. Waters of four mountain streams in the Mono Basin were made available for export. The safe yield of the aqueduct system was increased by approximately 35 percent.

During this period three large reservoirs were added to the aqueduct system. The completion of Crowley Lake, Grant Lake and Bouquet Reservoir along the aqueduct added 268,000 acre-feet of storage to the system and brought the total aqueduct reservoir storage to 350,000 acre-feet.

To import Colorado River water into Los Angeles, Department of Water and Power engineers in 1923 had started investigations of possible aqueduct routes between the River and the City. Los Angeles joined with other Southern California communities in 1928 to form the Metropolitan Water District (MWD). In 1931 the citizens of these communities voted a bond issue of $220 million for MWD construction of the Colorado River Aqueduct. Work on the project began the following year.

Colorado River water was made available to the Los Angeles area when the 300-mile long aqueduct from Parker Dam was completed in 1941. It would assure the City a supply to meet growth demands for several decades.

Long years of intensive power planning also brought results. Hoover Dam was completed in 1935 and the power plant began regular operations in October 1936. Hydroelectric power was delivered to Los Angeles via the 266-mile long, three-circuit Boulder Transmission Line. The DWP-built line was designed to operate at 287,500 volts. It was the highest voltage transmission line built up to that time and remained so for 20 years. Hoover Dam Power Plant provided Los Angeles with 455,000 kilowatts of power.

The new electric power for Los Angeles served rapid business, commercial and industrial development providing thousands of new jobs to take up the slack of depression-created unemployment.

An important 1937 development was the DWP purchase of the electric system of the Los Angeles Gas and Electric Corporation for $47 million. More than 180,000 new meters were added to the municipal electric system.

DWP efforts to benefit Los Angeles consumers with even lower cost electricity continued. Power rates were reduced by 10 percent in 1936; by 5 percent in 1937.

Los Angeles' population was 1,504,277 at the end of the decade.

A DWP field crew makes preparations for a stringing operation on the 266-mile long Boulder power transmission line during contruction in 1935. Tractors were used to pull guide lines through the stringing sheaves on the transmission line towers. The guide lines in turn were used to pull in the hollow copper conductor. The three-circuit line began delivering Boulder power to Los Angeles in 1936.

Era of the metropolis
1940-1950

When the U.S. entered World War II in 1941, Los Angeles swiftly became one of the nation's most important centers of war material production. Growth of industry and commerce during the war and in the post-war era brought large numbers of people to Los Angeles.

A Charter amendment approved by voters in 1947 permitted the DWP to issue revenue bonds for expansion of facilities without the requirement of a vote of the people, as is necessary with general obligation bonds. The DWP was thereby given latitude in planning ahead to meet the City's anticipated needs, subject to the approval of the Mayor and the City Council.

In the post-war period the DWP began the development of a system of large pipelines and additional reservoirs to permit a more efficient transmission and interchange of water from the various sources of supply into many diverse parts of the City.

The Harbor Generating Station was under construction during World War II. Its first 65,000-kilowatt unit was placed in operation in 1943 in time to provide electric power for the war effort. The power plant which has five generating units with a total capacity of 384,000 kilowatts, was completed in 1949.

Initial construction of the Owens River Gorge Hydroelectric Project in the Eastern Sierra region to harness the power potential of the river in its descent from Crowley Lake to the floor of the Owens Valley began in 1949.

By 1950 the City's population was 1,970,358, fourth largest in the nation.

Progress continues 1950·1960

The planning of the early post-war period began to bear fruit in the 1950's when many new major water and power projects were completed.

Several new reservoirs were constructed and older reservoirs were enlarged or otherwise improved. The new Eagle Rock, Green Verdugo and Upper Stone Canyon Reservoirs provided added capacity of about 253 million gallons. Silver Lake, Ivanhoe, Franklin Canyon and Lower Stone Canyon Reservoirs were modified.

New major water trunk lines were constructed within the City. The largest, begun in 1952 and completed in 1956, was the 10-mile long Eagle Rock-Hollywood Conduit. Construction of this 68-inch diameter artery enabled the DWP to deliver up to 171 million gallons of Colorado River water daily into the Los Angeles distribution system.

The 20-mile long Granada Trunk Line was begun in 1954. The 48-inch diameter pipeline (daily capacity, 55 million gallons) was built to serve rapidly developing areas in the western San Fernando Valley.

The Owens River Gorge Hydroelectric Project consisting of three power plants with a combined generating capability of 110,000 kilowatts was completed in 1952. Energy was delivered 260 miles to Los Angeles over a newly constructed 230,000-volt transmission line.

Another historic milestone was reached in 1956 when the Valley Generating Station, begun in 1951, was placed in full operation. The new generating station supplied the City with 510,000 kilowatts of electric energy from four units.

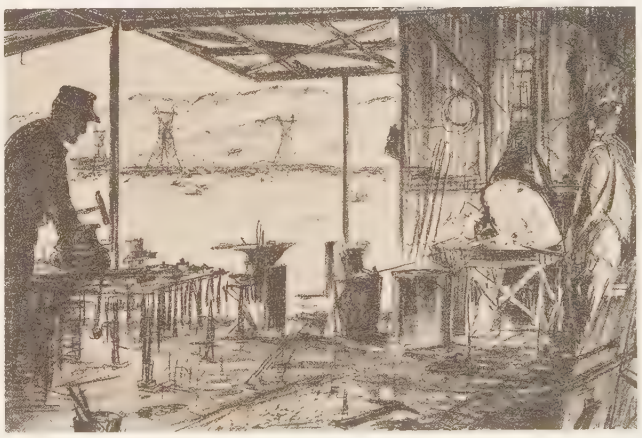
Although Valley Generating Station electric power was sufficient to supply an additional 700,000 people, it still was not enough energy to meet the City's projected requirements.

To help fill this need, construction was started in 1957 on Scattergood Generating Station on the coast near Playa del Rey. When it was completed in 1959 its two units provided the City with an additional 340,000 kilowatts of electric energy.

Construction was begun in 1959 on Haynes Generating Station near Seal Beach.

By 1960 the population of Los Angeles had jumped to 2,479,015. The City was the third largest in the United States.

Left: The man who did more than any other to furnish that vital element, water, to Los Angeles was William Mulholland (1855-1395), for many years the Chief Engineer of the municipal water system. The Los Angeles-Owens River Aqueduct was conceived and completed under his leadership. He personally initiated the DWP's six-year survey of 50,000 square miles of desert that resulted in his recommendation of the route ultimately selected for the Colorado River Aqueduct.



A blacksmith shop at Kingston Camp in the Mojave Desert during construction of the Boulder Transmission line. Special work tools were forged in shops like this one. The line began delivery of hydroelectric power to Los Angeles in the 1930's.

The eventful sixties
1960·1970

New business and industry continued to locate in Los Angeles during the decade. The demand for water and power increased as Los Angeles continued to attract more new citizens.

The decade also brought realization of a long-term DWP plan to house all of its headquarters personnel in a single structure to increase operating efficiency and provide improved customer service. Employees had previously been housed in several office buildings in the downtown area.

In June 1965, after three years of construction, work was completed on the 17-story Water and Power headquarters building at 111 North Hope Street. The attractive structure in the Civic Center is a City landmark.

After construction of six large generating units over a period of eight and one-half years, the giant Haynes Generating Station, largest power plant in the DWP system, was completed in June 1967. It supplies the electrical needs of 1.5 million people. The plant has a total generating capacity of 1,596,000 kilowatts which is larger than the generating capacity of the power plant at Hoover Dam.

The unique DWP belt system of transmission lines serving the City was remodeled and raised to a higher voltage to further assure continued dependable electric service.

Construction was begun in 1964 on the Second Los Angeles Aqueduct to increase by about 50 percent water deliveries to the City from the Eastern Sierra. This aqueduct was completed at a cost of $89 million. It was placed in operation on June 26, 1970. Approximately 80 percent of the City's water supply is now imported from the Eastern Sierra watershed.

The new aqueduct completed the third phase of the development of the distant source of water serving Los Angeles. Initial development began in the early years of the Twentieth Century with the construction of the 233-mile long Los Angeles-Owens River Aqueduct.

Hydrologic studies show that there is sufficient water in the Owens Valley-Mono Basin area, including the Owens Valley groundwater basin, to supply both aqueducts and to support the region's domestic, recreational, farming and ranching activities.

The Second Los Angeles Aqueduct project, like the original project, diverts and exports surface water after it has served sports, fishing and other recreation activities. This aqueduct is also supplied in part by pumping only about one-third the safe yield of the vast Owens Valley groundwater basin. The integrity of City-owned watershed land in Inyo and Mono Counties is best maintained through DWP policies which serve to protect the natural environment. Since ranching is compatible with that goal, the DWP leases about 235,000 acres of the 307,000 acre total City-ownership in Inyo and Mono Counties for these purposes.

Provisions in these leases require that not less than 75 percent of such areas be kept open for public hunting, fishing and other recreational activities. More than 200,000 acres of scenic City-owned land, much of it adjacent to lakes and streams, are available for public enjoyment. The open land proviso also benefits many residents of the Inyo-Mono area who derive their livelihood from the sports, recreation and vacation service industry.

Decade of challenge 1970·1980

The challenge at the beginning of the decade was recovery from the devastating February 9, 1971 San Fernando earthquake.

The 1973 oil crisis and the 1976-77 drought brought unaccustomed shortages of fuel oil for generation and water supplies to Los Angeles residents. The challenges of natural disaster and physical shortage were met by the strength of the systems and the conservation efforts by the public.

New measures were taken to further strengthen systems reliability by reconstruction, new construction and diversification. Facilities and personnel are presently geared to efficiently contend with emergencies involving potential and actual interruption or reduction of services.

WATER DEVELOPMENTS

New Water System facilities were planned and constructed to assure a reliable and safe water supply for Los Angeles.

Los Angeles Reservoir Construction

Construction of the 10,000 acre-foot Los Angeles Reservoir was completed in April 1977 and the reservoir was placed in operation in August 1977. The reservoir replaces Upper and Lower Van Norman Reservoirs which were damaged by the 1971 San Fernando earthquake. The new reservoir serves as a terminal storage facility for the Los Angeles-Owens River aqueducts and will also provide necessary regulatory and emergency storage for the Los Angeles water distribution system.

As a result of the 1971 San Fernando earthquake, the DWP investigated the seismic safety of several dams and reservoirs. These dams and reservoirs were constructed in the early 1900s by the hydraulic fill method. The investigation resulted in a program to increase the stability of several of the old dams. For example, Silver Lake Reservoir was replaced by a new reservoir in 1977. Construction of replacement reservoirs began in 1980 at Lower Franklin and in 1981 at Fairmont.

POWER DEVELOPMENTS

An era of power utility inter-dependence began during the decade. This cooperative effort was necessary to meet rising power demands, to minimize DWP's use of fuel oil and to maintain the lowest possible rates for customers. Such cooperation is evident in the many huge power projects recently completed and under construction in which many utilities share in the construction costs, maintenance costs and power generated.

Mohave Generating Station

The Mohave Steam Electric Generating Station, located near the Colorado River below Davis Dam in southern Nevada, was completed in October 1971. The coal-fueled plant was built as a joint venture with the Southern California Edison Company, Nevada Power Company and the Salt River Project of Arizona. DWP's 20 percent share of the plant's 1,580,000 kilowatts amounts to 316,000 kilowatts.

Navajo Power Plant

The Navajo Power Plant with a capacity of 2,250,000 kilowatts was built near Page, Arizona. Participants are the DWP, The U.S. Bureau of Reclamation, Arizona Public Service Company, Nevada Power Company, Salt River Project, and Tucson Electric Power Company. Groundbreaking ceremonies were held in April 1970. The first 750,000-kilowatt unit of the three-unit coal-fired plant was placed in service in February 1974, and subsequent units in December 1974 and November 1975. The DWP has a 21.2 percent share, about 477,000 kilowatts. In addition to this capacity, the DWP purchases 73,000 kilowatts of Navajo layoff capacity from the United States Bureau of Reclamation. A transmission line and coal transport system are included in the total project.

Transmission Line Conversion

The DWP completed the conversion of one of the three Boulder transmission lines from 287,000 volts to 500,000 volts to transmit power to Los Angeles from steam generating stations in Arizona and Nevada.

Additional 500,000 volt transmission is planned to increase power line capacity from other distant energy sources.

Pacific Intertie

The 846-mile long, 800,000-volt direct current transmission line, which runs from Los Angeles to the Columbia River in Oregon, was placed in service during May 1970. The Los Angeles Department of Water and Power constructed a 581-mile long segment of the line from Los Angeles to the Oregon-Nevada border where it connects with the federally built portion of the line. This direct current line is one of the major transmission lines of the complex Pacific Intertie System. The line was the longest-distance, highest-capacity (rated capacity 1,440,000 kilowatts) direct current transmission line in the world. It enables low cost hydroelectric power generated at Federal Columbia River Power System dams to be delivered to Los Angeles, and enables mutually beneficial sale and exchange contracts with other utilities. The Department which obtains about 560,000 kilowatts, shares the line with others. Southern California Edison Company utilizes half of the transmission capacity of the line, paid half of the construction cost, and pays half of the annual operation and maintenance cost of the line and the terminal facilities including the Sylmar Converter Station, built and operated by the DWP. The municipal power systems of Burbank, Glendale and Pasadena have financial arrangements for the transmission capacities used by them. The line was upgraded in 1985.

Castaic Power Plant

The Castaic Power Plant, one of the largest pumped storage hydroelectric projects in the world, was built by the DWP at Castaic Reservoir. The power plant capacity is 1,247,000 kilowatts and is used by DWP during peak load periods to minimize the use of fuel oil at other DWP plants.

Castaic is being operated by the DWP as a peaking capacity plant. California Aqueduct water drops more than 1,000 feet from Pyramid Reservoir, a distance of 7.5 miles, through a 30-foot diameter tunnel to drive six main turbine generators of 240,000 kilowatts each and a smaller 55,000-kilowatt pump starting generator. The six main generators are reversible as motors, the turbines as pumps, to lift water back to Pyramid Reservoir in off-peak periods for reuse during peak periods. The first of the 240,000-kilowatt units began power delivery in 1973.

Capacity from Castaic helped other utilities in California meet their needs as well. Through appropriate contractual arrangements, DWP can recover an additional increment of the investment of its ratepayer's funds.

A 230-kv transmission line transmits power from Castaic to DWP's high voltage belt line system.

Foothill Generating Plant

The $3-million, 11,000-kilowatt Foothill Hydroelectric Generating Plant, located at the terminus of the Second Los Angeles Aqueduct in the San Fernando Valley, was placed in service in October 1971, to provide additional electric power by utilizing the energy available in the falling water not needed for the high level water distribution system.

Today's modern Los Angeles Water System began on November 8, 1867 when the Common Council awarded a contract to lay 5,000 feet of water mains made of iron for domestic water service in the City. The 2-inch and 3-inch iron pipes replaced hollowed log conduits which had been in use since 1857.

Decade of transition 1980-1990

The 1980's began a period of transition as the DWP moved away from traditional fuel oil generation into alternate energy resources, including coal-fueled, nuclear power, geothermal, and solar generation. In addition, the Water System, in a move to further enhance the Los Angeles water supply, is constructing a water filtration plant and has also undertaken studies to investigate the possible treatment and reuse of wastewater in the Los Angeles area.

Reservoir Reconstruction

Investigation of the seismic stability of existing dams and reservoirs is continuing. Plans are begin investigated to replace South Haiwee Reservoir.

Ascot Reservoir has been determined to be seismically adequate at its current operating level. However, plans are being developed to replace its roof or to provide a new facility.

The Upper and Lower Franklin Reservoirs were removed from service and replaced in 1983 with the Lower Franklin Reservoir No. 2, the Upper Franklin Reservoir Bypass Line and Surge Basin. Sawtelle Reservoir was removed from service in 1983 and will be replaced by an enlarged Lower Stone Canyon Reservoir Outlet Line to provide additional supply capacity to Sawtelle Power Plant and Sawtelle Tank.

Water Quality Improvement

Although the Department's treatment methods have been successful in

providing Los Angeles with a safe and wholesome water supply, federal and state drinking water standards now require reduction of the turbidity (cloudiness) that occurs naturally in the Owens River watershed.

Construction of the Los Angeles Aqueduct Filtration Plant is underway and, when operational, will reduce the turbidity of the aqueduct supply to comply with federal and state regulators. Construction began in June 1983. The facility is scheduled for operation in early 1987.

Covers were constructed for DeSoto Reservoir and the Upper Franklin Surge Basin in 1984, and are being studied for other facilities.

Plans to modernize or construct several chlorination facilities are also progressing. New chlorination stations have been constructed at Los Angeles Reservoir and Lower Franklin Reservoir No. 2 and will be constructed at Upper Stone Canyon Reservoir and for the North Hollywood complex.

Wastewater Reuse

The DWP and other agencies have been investigating the treatment and reuse of wastewater in the Los Angeles area for many years. Potential uses for reclaimed water include: supplemental groundwater recharge, seawater intrusion barrier supply, park and landscape irrigation, and industrial water supply. Public health concerns and high costs for treatment and distribution of reclaimed water have restricted development of this valuable water resource.

In an attempt to resolve these problems, the DWP participated with a number of local, state and federal agencies in a regional study to identify potential water reclamation projects in Los Angeles and Orange Counties.

The Los Angeles-Glendale Water Reclamation Plant (20 million gallons per day capacity) designed and constructed by the Department of Public Works (DPW) is in operation. Water from this plant is being used for irrigation in nearby Griffith Park and landscaping along the Golden State Freeway.

The DPW Donald C. Tillman Water Reclamation Plant (40 million gallons per day capacity) was completed in 1984. Reclaimed water from the Tillman Plant will initially be used for irrigation of the plant site and golf courses and parks in the adjacent Sepulveda Dam Recreation Area. The DWP is currently developing a project to deliver reclaimed water from the Tillman Plant to an additional golf course, two cemeteries and a proposed commercial and residential complex.

Studies are also underway to determine the feasibility of using water from the Tillman Plant for recharge of the San Fernando Groundwater Basin if health and other problems can be solved.

California State Aqueduct

The West Branch of the California State Aqueduct has the potential capacity to deliver 2 million acre-feet of water annually to Southern California from the north. In the future, Southern California will depend increasingly on this new supply. Before the full capacity of the aqueduct is reached, however, additional facilities must be constructed in Northern California. Construction of these new facilities should begin soon and continue as the need for water grows in Southern California.

This need is becoming more critical because Metropolitan Water District has reduced its diversions from the Colorado River since the Central Arizona Project became operational late in 1985.

Los Angeles shares in California State Aqueduct supplies through the City's membership in Metropolitan Water District of Southern California.

Future Energy Resources

The DWP, in conjunction with other utilities, is participating in the development of a coal-fueled and a nuclear powered generating station, in addition to geothermal, solar generation, and co-generation projects.

Intermountain Power Project

Construction began in 1981 for the $5-billion Intermountain Power Project in Utah. The Department will be entitled to 679,000 kilowatts from the coal-fueled generating station when completed in 1987. The 1,522,000-kilowatt plant will supply power to 36 utilities in Utah and California. As project manager, the DWP is responsible for the design, construction and operation of the plant. A ±500-kilovolt, direct current transmission line has been built from the generating station to Adelanto, California. From there, the power will come to Los Angeles over the DWP transmission system.

White Pine Power Project

A 1,500,000-kilowatt, coal-fueled power project is being planned for White Pine County in eastern Nevada. The DWP would be responsible for the design and construction of the project and would receive approximately 600,000 kilowatts when it is completed in the early 1990s.

Palo Verde Nuclear Generating Station

The DWP has purchased through the Southern California Public Power Authority, approximately 150,000 kilowatts of power from the Palo Verde Nuclear Generating Station which is scheduled for completion in 1987. In addition, the DWP has exchanged its 210,000 kilowatt ownership in the coal-fueled Coronado Generating Station for an equal amount in Palo Verde. Construction is completed on the three units located about 50 miles west of Phoenix, Arizona. The first two units have been placed into operation.

Solar One Demonstration Plant

A 10,000-kilowatt solar thermal central receiver pilot plant has been completed in the Mojave Desert near Barstow. The DWP is a partner along with other utilities and governmental agencies in the $140 million project. The pilot plant experiment will be used to develop information towards future commercial plants of similar design.

Geothermal Resources

The DWP is assessing its geothermal leases at Coso in Inyo County. If exploratory efforts confirm an adequate resource for electrical generation, a demonstration facility could be in operation by the end of the decade.

The DWP also owns lands in the Mono-Long Valley Known Geothermal Resource Area that may have geothermal potential. The DWP has no immediate plans for its Mono-Long Valley lands, but using third parties to explore and develop the lands is being considered.

Cogeneration Projects

A total of 75,000 kilowatts of cogeneration facilities has been connected to the DWP from industries in the area. The DWP is purchasing available electric energy from these facilities. It is anticipated other facilities will be developed in the future.

Pacific Intertie Upgrade

The Pacific Intertie DC Transmission Line was increased to 1,000,000 volts (±500 kv). It now has a rated capacity of 2,000,000 kilowatts. The upgraded line was energized on Jan. 31, 1985.

ENVIRONMENTAL PROTECTION

In January 1970, the Interagency Committee on Owens Valley Land and Wildlife was formed. Membership in the

Committee includes several federal, state, county and city agencies which have interest in multiple-use management of City and federal lands in the Owens-Mono Valleys. Accomplishments of this committee include two wildlife viewing points, a Visitor Information Center near Lone Pine, a Tule Elk management program, carrying capacity forage studies for wildlife and livestock and programs to enhance unique ecological areas.

In 1982, the County of Inyo and the City of Los Angeles formally agreed to work together to identify the water needs of both groups and to recommend methods to meet those needs. A standing committee composed of City and County elected officials, commissioners and staff was formed along with a support committee of technical personnel. A direct development of these committee meetings was a cooperative study between Inyo County, the City and the United States Geological Survey. Comprehensive groundwater and vegetation studies were started in 1983 with a projected five-year life span. The total cost of these studies is expected to exceed $2 million.

Efforts of the standing committee also led to a comprehensive agreement which received final approval in January 1985. The purpose of the agreement is to develop a joint management plan for the Owens Valley groundwater basin that meets the water needs of the City and County while providing for environmental protection and enhancement.

The DWP has been honored for reduction of stack emissions from urban power stations and for protection of marine life against thermal effects of power plant cooling water discharge. Many research activities are focused in the area of air emissions, including a system for innovative nitrogen oxide control and computerization of air quality information.

The public is encouraged to participate in the environmental evaluation process in siting new power generation, transmission and distribution facilities.

CONSERVATION

The DWP has active, comprehensive conservation programs emphasizing the efficient use of water and energy to minimize the expenditure of natural resources. For example, an intensive energy management program began in 1980 to assist commercial and industrial customers in higher energy efficiency systems in their operations. To further encourage wise water usage, water conservation kits were mailed in June 1981 to every Los Angeles household. In 1981 the DWP initiated a two-year Residential Irrigation Study Project to evaluate the effectiveness of landscape water conservation programs. Long range educational programs are directed to eliminate wasteful practices and to increase efficiency for necessary uses. In addition, a DWP hotline, (213) 481-5800, has been established to provide water and energy saving tips to DWP customers.

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Los Angeles has overcome unique geographical obstacles to progress in stature from a tiny pueblo to a world-famed metropolis of more than 3 million people.

The Department of Water and Power has played a major role in the City's development. Its long range planning has provided adequate supplies of water and electricity to meet the needs of the citizens of Los Angeles.


Los Angeles Department of Water and Power
Major Supply and Distribution Systems
Los Angeles and Vicinity
LEGEND
WATER
Aqueducts
Wells
Main Supply Lines
Principal Reservoirs
City of Los Angeles
POWER
Hydro Power Plants
Thermal Generating Stations
Main Transmission Line – A.C.
Pacific Intertie Line – D.C.
Power Receiving Stations
Switching Stations
Interconnections
CALIFORNIA AQUEDUCT (West Branch)
338-MILE LOS ANGELES–OWENS RIVER AQUEDUCT SYSTEM
PACIFIC INTERTIE HVDC TRANSMISSION LINE
CASTAIC POWER PLANT
CASTAIC RESERVOIR (State)
BOUQUET RESERVOIR
AQUEDUCT POWER PLANTS
SECOND LOS ANGELES AQUEDUCT SYSTEM
OWENS GORGE TRANSMISSION LINE
McCULLOUGH-VICTORVILLE TRANSMISSION LINE
INTERMOUNTAIN POWER PROJECT HVDC TRANSMISSION LINE (Under Construction)
SAN FERNANDO AND FOOTHILL POWER PLANTS
SYLMAR CONVERTER/SWITCHING STATIONS
SO. CAL. EDISON CO. INTERCONNECTION
OLIVE SWITCHING STATION
ADELANTO CONVERTER/SWITCHING STATIONS (Under Construction)
MACLAY RESERVOIR
VICTORVILLE-TOLUCA TRANSMISSION LINE
LOS ANGELES RESERVOIR COMPLEX
L.A. AQUEDUCT FILTRATION PLANT (Under Construction)
GREEN VERDUGO RESERVOIR
RINALDI STATION
STATION J
STATION M
VALLEY GENERATING STATION
VICTORVILLE-RINALDI TRANSMISSION LINES
STATION E
VICTORVILLE SWITCHING STATION
STATION T
STATION S
GLENDALE-BURBANK INTERCONNECTION
STATION U
WELLS
LOS ANGELES RIVER
SO. CALIF. EDISON CO. INTERCONNECTION
ENCINO RESERVOIR
EAGLE ROCK RESERVOIR
HOLLYWOOD RESERVOIRS
STONE CANYON RESERVOIRS
STATION G
SANTA YNEZ RESERVOIR
FRANKLIN CANYON RESERVOIR
PASADENA INTERCONNECTION
FRANKLIN POWER PLANT
STATION H
SILVERLAKE RESERVOIR
STATION A
STATION F
STATION P
STATION K
SO. CALIF. EDISON CO. INTERCONNECTION
STATION D
RIVER SWITCHING STATION
STATION N
GRAMERCY SWITCHING STATION
STATION B
SCATTERGOOD GENERATING STATION
LOS ANGELES RIVER
HALLDALE STATION
STATION C
PALOS VERDES RESERVOIR (MWD)
STATION Q
HAYNES GENERATING STATION
HARBOR GENERATING STATION
SAN PEDRO RESERVOIR
CELILO DC-AC CONVERTER STATION
OREGON
PACIFIC HVDC INTERTIE TRANSMISSION LINE
CALIFORNIA
NEVADA
INTERMOUNTAIN POWER PROJECT (Under Construction)
WHITE PINE POWER PROJECT (Proposed)
UTAH
LOS ANGELES OWENS RIVER AQUEDUCT SYSTEM
CALIFORNIA AQUEDUCT (Owens Valley Phase)
OWENS GORGE POWER PLANTS
OWENS GORGE TRANSMISSION LINE
NAVAJO GENERATING STATION
McCULLOUGH SWITCHING STATION
EL DORADO SUB-STATION
HOOVER DAM POWER PLANT
MEAD SWITCHING STATION
SYLMAR DC-AC CONVERTER STATION
SOLAR ONE
MOHAVE GENERATING STATION
CASTAIC POWER PLANT
BOULDER POWER TRANSMISSION STATION
CORONADO GENERATING STATION
Los Angeles Area
COLORADO RIVER AQUEDUCT
Phoenix Area
PALO VERDE GENERATING STATION (Under Construction)
ARIZONA

City of Los Angeles

Incorporated under American Law April 4, 1850

Spring Street

Calle Principal

Main Street

Los Angeles Street

Legend

1. Church
2. Lugo House
3. Olvera House
4. Avila House
5. Downey House
6. Ocampa's Plaza
7. Jose A. Carrillo
8. Ignacio Coronel
9. Abel Stearns
10. Arcadia Block
11. Bell Block (Fremont's Hdqrs.)
12. Bella Union Hotel
13. Temple Block
14. Juan Temple's Yards
15. Rocha House, City Hall
16. Jail
17. Fort Moore
18. Benjamin Eaton (Old Calaboose)
19. Benjamin Hayes

LOS ANGELES DEPARTMENT OF WATER AND POWER REV. 8/86 7.5M